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sized city filter plants. The cities in the neighborhood of Troy supply good illustrations of the different modern methods of water purification.

THE *Bulletin* of the American Mathematical Society states that during the Easter vacation of 1912 an extensive course in mathematics and physics for advanced teachers will be held at Göttingen under the direction of Professor F. Klein.

DR. C. RANKIÄR has been appointed professor of botany, and director of the Botanical Gardens at Copenhagen.

DR. GILBERT T. MORGAN, assistant professor of chemistry at the Imperial College of Science and Technology, South Kensington, and junior hon. secretary of the Chemical Society, has been appointed to the chair of chemistry at the Royal College of Science, Dublin, vacant by the retirement of Sir Walter Noel Hartley, F.R.S.

DR. THEODOR BOVERI, professor of zoology at Würzburg, has been called to Freiburg.

#### DISCUSSION AND CORRESPONDENCE

##### NUMBER OF STUDENTS PER TEACHER

TO THE EDITOR OF SCIENCE: It appears to me that the only correct way to determine the average number of students handled per teacher in any school is to divide the number of student hours per week by the number of teacher hours per week.

For example, let there be 15 teachers and 300 students. This does not mean that on the average one teacher instructs 20 students in a recitation or class. Suppose each student takes 15 hours per week, and that each teacher instructs only 12 hours per week. There are therefore  $15 \times 12$  classes per week for  $300 \times 15$  students, since each student appears in 15 classes. The average number of students in each class is therefore

$$300 \times 15 \div 15 \times 12 = 25.$$

In general, therefore, the average number of students which each instructor has to handle in one recitation is the number of student hours divided by the number of teacher hours, in one week.

The average number of hours per week re-

quired of each student and each teacher, viz., the number of student-hours and teacher-hours per week divided respectively by the number of students and teachers, are also important numbers in respect to the average work required of students and teachers.

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##### FUNDULUS AND FRESH WATER

"*Fundulus* and Fresh Water" in your issue of December 29, 1911, recalls some experiences I have had with these fishes in transferring them from salt and brackish to fresh water. *Fundulus heteroclitus* may be so transferred more safely, the less degree of salinity there is in the water whence they were derived. Most of my specimens came from the Hackensack River and its creeks, varying from the saline Newark Bay to the almost entirely fresh water at Little Ferry and at the heads of the creeks. While very few of those transferred from salt water directly to fresh survived the sudden change, an increasing number survived of those gradually transferred in the course of a week or two, through a number of changes of water. My records show that such fishes lived from four to six months, up to two years; one lived over three years. I never succeeded, however, in making a successful transfer of the highly colored breeding males.

*Fundulus diaphanus*, though known almost entirely as a fresh water species, when taken from salt water also offers difficulties in transferring, thus showing that successful transfer in all cases appears to be a matter of very gradual accomplishment.

*Fundulus majalis* I never succeeded in transferring, no doubt because of its being a purely marine species.

*Cyprinodon variegatus* also can be gradually accustomed to a change of water, but being practically only an anadromous fish during breeding time does not very long survive.

It is possible that these cyprinodonts being great rovers can ill bear small quarters and this may be one reason for their shortlivedness in captivity, as compared with the quieter cyprinids for instance.

Transfers were never successfully made to "hard," that is, well water. I never used distilled water but simply rain or city tap water.

*Experiments made with Sticklebacks.*—*Gasterosteus aculeatus* and *pungitius* and *Apeltes quadracus* also bear transfer which may ordinarily be made quite suddenly and without great loss. I transferred back an *aculeatus* directly from fresh to salt water; it survived only a few days, but as it was a spent male (in the fresh water) this may not be considered a fair test.

Suddenly transferred fishes drop to the bottom of the tank and slowly move about after some time; this is due to the difference in density chiefly, but differences in the temperatures of the water also have this effect, though it is sooner overcome.

EUGENE SMITH

HOBOKEN, N. J.

#### SCIENTIFIC BOOKS

*The Flora of Boulder, Colorado and Vicinity.*

By FRANCIS POTTER DANIELS. Volume II., No. 2, University of Missouri Studies. Price, \$1.50.

The author of this excellent piece of work is not a professional botanist but a specialist in Romance languages. While engaged in teaching French in the summer session of the University of Colorado in 1906 he made the collections upon which the present report is based. Through the University of Missouri, with which institution Dr. Daniels was formerly connected, his book of over 300 large octavo pages has been issued as a number of the "University of Missouri Studies." It is sumptuously printed in large type with wide margins and generous spacing.

Dr. Daniels collected 1,036 species of plants during the single summer that he was in Boulder. To this number are added in his printed list some species reported from the vicinity in Rydberg's "Flora of Colorado" together with others from various sources. The total number listed seems to be about 1,240. At various points in the body of the list new species and varieties are described. It is unfortunate that because of lack of time Dr.

Daniels was unable to consult the university herbarium at Boulder. This collection, containing some 5,000 sheets of Boulder County specimens, is, therefore, not reported upon in the present publication. However, the large number of plants collected by the author himself must surely comprise a very considerable part of the flora. His list is bound to be of great use to students of the local flora.

In addition to the systematic list of species and localities there is a fifty-page introduction in which various ecological matters are discussed. This is evidently not written for the professional botanist for the language is popular, not to say "breezy." One is therefore just a bit surprised by such terms as *Ensiformes*, *Rimosæ*, etc., which, set in heavy bold-face type, stare uncompromisingly at the patient reader who may happen to be innocent of a knowledge of the classical languages.

A very full index completes this creditable publication.

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#### SCIENTIFIC JOURNALS AND ARTICLES

*Terrestrial Magnetism and Atmospheric Electricity* for September, 1911, contains the following articles:

"Magnetic Chart Errors and Secular Changes in the Indian Ocean," by L. A. Bauer and W. J. Peters.

"Comparisons of Magnetic Observatory Standards by the Carnegie Institution of Washington, No. II.," by J. A. Fleming.

"Data for Abruptly-beginning Magnetic Disturbances, 1906-1909, No. II.": Reports from Batavia-Buitenzorg; Zi-ka-wei and Lu-kia-pang; Kew; Mauritius; Eskdalemuir; Dehra Dun, Kodaikanal, Barrackpore and Toungoo; Tortosa; Samoa; Falmouth; De Bilt; Rud Skov; Pilar; and additional data for Potsdam; Agincourt; Porto Rico, Cheltenham, Baldwin, Sitka and Honolulu.

"Peculiar Magnetic Disturbances of December 28-31, 1908," by R. L. Faris.

"The Magnetic Character of the Year 1910," by G. van Dijk.

"Mean Values of the Magnetic Elements at Observatories," compiled by J. A. Fleming.